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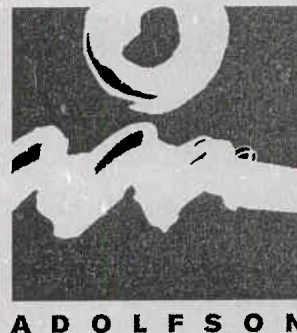
OCTOBER 2000

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MADSEN CREEK TRIBUTARY EROSION STABILIZATION PROJECTS BIOLOGICAL ASSESSMENT

For Coordination with
National Marine Fisheries Service and
US Fish and Wildlife Service

TECHNICAL DOCUMENT AND RESEARCH CENTER
KING COUNTY DEPARTMENT OF
NATURAL RESOURCES AND PARKS



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1.0 SUMMARY

The King County Wastewater Treatment Division (WTD) is proposing to stabilize erosion and improve the riparian forest canopy in the Madsen Creek ravine. Madsen Creek is in Watershed Resource Inventory Area (WRIA) 8, draining into the Cedar River approximately five miles east of Renton, Washington. On behalf of the WTD, Adolfson Associates, Inc. (Adolfson) has prepared this Biological Assessment (BA) to facilitate review of the proposed action as required by section 7(c) of the Endangered Species Act (ESA). Under the ESA, the National Marine Fisheries Service (NMFS) regulates threatened and endangered marine fish and wildlife species, while terrestrial plants, animals, and inland fish species are regulated by the United States Fish and Wildlife Service (USFWS). These two regulating agencies are jointly referred to as the "Services." This BA has been prepared to facilitate coordination between the Army Corps of Engineers—the federal action agency—and the Services.

1.1 Objectives of this Assessment

This study has the following objectives:

- 1) To review published information and local knowledge of species within the project area¹,
- 2) To assess listed-species habitat in the project vicinity and downstream of the work sites,
- 3) To analyze and discuss potential effects of the proposed actions on ESA-listed species and habitats,
- 4) To discuss any necessary impact mitigation, and
- 5) To provide a recommendation with regard to effect determinations².

1.2 Purpose of the Proposed Action

The purpose of the proposed action is to improve the quality and quantity of habitat in Madsen Creek and in sections of the Cedar River near the confluence of Madsen Creek. This will be accomplished by reducing the mobilization of sediments from eroding tributary stream sections and planting conifers in the Madsen Creek ravine. Sediment mobilization will be reduced by:

¹ Information on baseline conditions was drawn from the *Madsen Creek Tributary Stabilization Design Report Draft* (WTD, January 1999), *Inventory of Four Tributaries to Madsen Creek* (Aquatic Resource Consultants, January 1999), and other public resource documents as referenced in the text. In addition, Adolfson contacted regional experts with specific knowledge of habitat conditions and fish use within Madsen Creek. A listing of pertinent references and contacts is provided at the end of this report.

² If the action agency determines that a project is "likely to adversely affect" listed species or critical habitat, then formal consultation is required, unless an exception applies. If the action agency determines that a project is "not likely to adversely affect" listed species or habitat, and the services provide written concurrence, formal consultation is not required.

- 1) providing detention for stormwater in the West and Northwest Tributary subbasins,
- 2) installing boulder and log-jam structures in upper drainage erosion sites, and
- 3) modifying an existing by-pass structure in the upper basin.

With one exception, heavy equipment will not operate in either a stream channel or riparian zone as part of the proposed work. A logging skyline, helicopter, crane, or hand crew will be used for virtually all material placement and movement. However, at the upper end of the northwest tributary, an excavator will operate from an existing road to place a small amount of material into the channel.

1.3 Effect of the Proposed Actions on ESA Listed Species

Table 1 lists endangered and threatened species that could be present in potentially affected areas and summarizes potential project-related impacts to these species. Refer to Section 7.0 for a detailed discussion of the effects of the proposed action on these species.

Table 1. Potential Project-Related Impacts to ESA-Listed Species

Common Name	Status	Likely Exposure of Each Species to the Proposed Actions	Project Effects
chinook salmon	Threatened* (NMFS)	Some rearing occurs in the Cedar River year-round (one mile downstream), and limited rearing may sometimes occur in Madsen Creek near the mouth (0.9–1.0 mile downstream) (Figure 3b). Spawning does not generally occur until the winter in the Cedar River (after in-water work) and does not likely occur in Madsen Creek. <u>The projects will likely benefit chinook salmon through reductions in sediment to the Cedar River and increases in prey abundance.</u> Low-impact installation, water quality monitoring, and other mitigating measures will prevent construction-related impacts.	May affect, not likely to adversely affect
bald eagle	Threatened ^{††} (USFWS)	The closest nest/roost is located approximately 4.5 miles from the project boundary, and the project is not inside a known eagle forage area (Figure 3a).	May affect, not likely to adversely affect
bull trout [‡]	Threatened (USFWS)	Only ten stray adults have been observed in the Lake Washington basin (below Chester Morse Lake) since 1981, and only three in the Cedar River system (King County, 2000b). The Cedar River mainstem is considered an “intermittent use area” for bull trout adults and sub-adults (USFWS, unpublished information, 2000) (Figure 3c). More importantly though, no reproducing populations are known in the Lake Washington basin (Chan, personal communication, 2000).	May affect, not likely to adversely affect

* Threatened: Species are likely to become endangered within the foreseeable future.

^{††} The USFWS published a draft rule in the Federal Register proposing that bald eagle populations in Washington State be removed from the list of threatened species. However, until USFWS publishes a final rule delisting bald eagles, they are required to be addressed in Biological Assessments and receive equal consideration to other listed species discussed herein.

[‡] Dolly Varden (*Salvelinus malma*), a species of native char in the same genus as bull trout, have been proposed for listing by the USFWS due to similarities in appearance to bull trout. Dolly Varden and bull trout have similar life histories and habitat requirements, and are discussed jointly in this document.

2.0 PROJECT DESCRIPTION

2.1 Background

Madsen Creek is a tributary to the Cedar River, crossing State Route 169 near 149th Avenue Southeast in the Renton area of unincorporated King County (WRIA 8, Township 23N, Range 5E, Sections 22, 23, 26, and 27) (Figure 1). Its drainage basin is almost entirely encompassed by the Fairwood residential community, which began development in the 1960's. Early development created impervious areas, which increased peak flows beyond the capacities of the natural streambeds. Accelerated erosion that followed the increased peak flows has destabilized stream channels and degraded fish habitat throughout the drainage. Recent efforts at peak-flow control through upland storage have been insufficient to stabilize the drainageways because of the fragile nature of the geology and the steepness of the slopes.

Three tributaries to Madsen Creek—the West, the Northwest, and East Fork—are small, first-order streams that have been heavily impacted by the increased flows from development. High water velocities during heavy flows have caused severe erosion of glacial till and outwash soils, which consist of sand, silts, and clays. As a result, a ravine landscape has been created with jagged cuts 30 to 50 feet high in the hillsides.

The erosion threatens the stability of the hillslopes and sends sediments and debris into the main stem of Madsen Creek. This material contributes to the destabilization of the creek's habitat and fills in the lower streambed, causing the stream to overflow. Over the years, King County has constructed several facilities including a stream by-pass, sediment pond, and flow-control pond in Madsen Creek. The projects have controlled particularly dangerous situations, but have not been of the scale necessary to provide the control flows to pre-development conditions.

The King County Wastewater Treatment Division is also proposing to construct a new gravity sewer pipeline to convey sewage flows from the Fairwood community to the trunk sewer at the bottom of the hill along the Maple Valley Highway. Although these two projects are not related, construction of the gravity sewer will occur in close proximity to areas where water quality and habitat enhancement activities are proposed.

2.2 Project Information

Project Name:	Madsen Creek Tributary Erosion Stabilization Projects
Location:	Township 23 North, Range 5 East, Sections 22, 23, 26, and 27
Project Proponent:	King County Department of Natural Resources Wastewater Treatment Division 201 South Jackson Street, MS KSC-NR-0507 Seattle, Washington 98104-3855
Contact:	Stan Hummel Phone: (206) 684-1844/ Fax: (206) 684-1959 stan.hummel@metrokc.gov

Proposed timing or schedule: Work is planned to occur in the summer of 2001. A Hydraulic Project Approval (HPA) will be required for the project. The HPA would likely allow in-stream work between June 15th and September 15th, 2000.

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2.3 Objectives of the Proposed Actions

The objectives of the proposed action are based on a needs analysis documented in the draft *Madsen Creek Tributary Water Quality and Flow Control Report* (KCDNR, December, 1999). This report evaluated both flow control and water quality improvement needs, and identified the main needs for the tributary subbasins as:

- Flow control to reduce erosion and sedimentation;
- Community education to reduce household contamination sources; and
- Construction of water detention and treatment facilities to reduce peak flows and improve stormwater quality.

The needs analysis for flow control was based on use of the King County Runoff Time Series (KCTRS) runoff synthesis model and indicated a detention need of approximately 0.2 acre-feet of storage for every acre of development. This need was evaluated in terms of the United States Environmental Protection Agency (USEPA) all known available and reasonable treatments (AKART) standard, which identifies 1974 as the "initial" predevelopment year. Approximately 573 acres were identified as having been developed since November 1975, thus implying a potential post-development runoff storage need of approximately 105 acre-feet. Currently identified detention storage in the basin totals approximately 35 acre-feet. Additional detention was also determined to be a key component of water quality improvement, both through the reduction of erosion, as well as the potential for removal of street sediment and the natural attenuation (in detention ponds) of nutrients, coliform organisms, and metals.

2.4 Proposed Actions

The following sections describe the goals, objectives, and proposed methods of the proposed action, as well as a review of the secondary project features (i.e., grading, clearing, staging areas, etc.). Project design plans were reviewed by Adolfson to provide information on project elements, and the project proponent and project engineer were consulted to provide additional detail as required. The following Objectives and Enhancement Proposals are reproduced from the *Madsen Creek Habitat and Water Quality Enhancement Proposal* (King County, 2000).

In response to the directives provided by the County Council with regard to the Madsen Creek basin, and to implement County policies with regard to stream and wetland protection, the project has the following general goal and specific objectives:

GOAL:

- To improve the diversity and quality of habitat in the Madsen Creek stream system.

OBJECTIVES:

- Use measures that mimic natural systems with similar flow regimes.
- Reduce downstream sediment impacts to the stream system by stabilizing erosion-sensitive areas.
 - Where severe erosion is evident along the tributaries, improve their stability by a combination of flow attenuation and placement of streambed enhancement measures.
 - Improve stream channel stability and fishery and aquatic insect habitat along the Northwest Tributary channel.
 - Improve Madsen Creek channel habitat stability and quality in the vicinities of the discharges from the Northwest Tributary, wetland overflow, and East Tributary areas.
- Provide treatment of developed flow where effective.
- Improve fish usage by reducing the baseflow entry into the Bell Hill Slope bypass pipeline (see Design Plan figures in Appendix B).
- Maintain base flow conditions in the tributary channels.
- Increase the diversity of habitat along Madsen Creek by placement of large woody debris (LWD).
- Improve the forest structure of riparian corridors.

2.4.1 Enhancement proposals:

Proposals to achieve enhancement goals are listed as follows and are broken into two groups: those that affect the main stem of Madsen Creek and those that affect the tributaries.

2.4.1.1 *Mainstem Madsen Creek*

Improve Riparian Corridor Forest Cover. Tree cover in the existing corridor is almost entirely deciduous. Historic logging and past construction in the ravine have eliminated the coniferous overstory. To accelerate the natural course of forest succession toward a coniferous overstory, the enhancements will include planting approximately 6,000 small coniferous trees in the understory, comprised mostly of western red cedar and Sitka spruce, in a corridor

approximately 100 feet wide along the stream's length. These trees will be planted by hand, without the use of heavy equipment.

Diversify Stream Structure. Using logs, boulders, streambed gravel, and stumps, pool and refuge habitat will be increased in the main stem stream channel. The enhancement will develop eight to 15 log-boulder complexes, concentrating flow to develop scour pools and slack water areas for the reach of Madsen Creek from the sediment pond above State Route 169 to 600 feet above the confluence of the East Fork and Madsen Creek (Appendix B). These complexes will improve spawning habitat in the tail-out areas of the structures and rearing and refuge habitat in pool areas.

Reduce Baseflow Diversion into Bell Bypass Pipeline. The intake for the bypass pipeline that carries flow around the Bell Hill Slope slide area will be modified to reduce the interception of the stream's base flow. Two catch basins that intercept the flow will be retrofitted with an adjustable weir. After the work is completed, the weir will be adjusted to just above baseflow conditions when the stream aggrades. The area around the intakes will be supplemented with logs, boulders, and streambed gravel to provide stream characteristics that improve gravel passage through this section while causing fluctuations in flow level to direct high flow into the intake system. Downstream grade control log structures will be enhanced with the placement of logs and boulders to improve fish passage through them.

2.4.1.2 *Tributaries*

West and Northwest Tributaries Enhancement. There are three parts to the proposal to reduce the erosion occurring in the West and Northwest Tributaries of Madsen Creek. They include:

- The diversion of storm flow away from the West Tributary;
 - The construction of a facility to improve water quality and attenuate flows from the West and Northwest Tributaries basins (Appendix B); and
 - The use of natural elements to stabilize the Northwest ravine to carry flow from the facility to Madsen Creek.
- 1) The system will divert flow from the development to the West ravine and carry it about 2,000 feet to a proposed water quality and flow control facility on Bonneville Power Administration (BPA) right-of-way. A system of 24- and 30-inch pipes will be constructed at 145th Avenue Southeast and Southeast 162nd Street to divert development storm flows from the West Tributary. Base flows within the West Tributary will be unaffected. If the base flow is found insufficient to sustain the ravine's environment, which is unlikely, the system shall be designed to allow development flow to be metered into the ravine.
 - 2) The water quality and flow control facility will treat the runoff in a detention pond and water quality wetland having a volume of water between 3 and 4 acre-feet. Peak flow and duration control will be provided with 6 acre-feet of active stormwater storage regulated through a control structure into the Northwest Tributary. These

reductions attempt to mimic natural flow conditions produced by native forested conditions, produced by the combined tributary areas of the West and Northwest Tributaries. The flow rates will be less than present flow rates through the Northwest ravine.

- 3) Enhance habitat and stabilize the channel on the Northwest Tributary below the new detention pond through placement of LWD and boulders and through vegetation plantings. All placements would be designed to stand a flow rate assuming no attenuation by the flow control pond.
- 4) Because of the steep gradient of this tributary, ranging from eight to 50 percent, the streambed enhancement will result in it becoming largely a log and boulder cascade. Development of chutes and pools will likely increase where the grade is shallower. The entire length of the Northwest Tributary that is now deeply incised will be improved by the streambed enhancement, approximately 1,400 feet.

East Tributary. The East Tributary channel will be stabilized by LWD, boulder placement, and planting riparian vegetation. This work would extend from the confluence of the East Tributary with the East Fork, approximately 250 feet upstream to the outfall from the development. All stabilization structures would be designed to withstand peak 100-year, 24-hour storm flows.

East Fork Wetland Overflow. To reduce slides caused by overflow from a wetland onto the East Fork ravine slopes, this improvement will collect the water at the edge of the wetland and convey it through a pipe under the roadway to a riprap channel on the ravine slope. The channel will convey the overflow to the bottom of the East Fork ravine. The overflow will be collected in a catch basin placed along the maintenance road ditch just below the wetland. A pipeline will run from the catch basin, beneath the roadway approximately 350 feet, then on the surface of the ravine side slope an additional 130 feet to the East Fork of Madsen Creek. The site where the riprap channel will go into the ravine is a slope that was armored with rock after a slide caused by overflow from the wetland. Although there are closer routes into the ravine, they would require the disturbance of vegetation. The channel will come to the edge of the stream where flow will diffuse over logs, stumps, and boulders, therefore reducing the ability of concentrated flow to harm the stream channel (see design plans in Appendix B). These logs, stumps, and boulders will be placed to increase habitat and dissipate the flow over a broad area of the stream.

This alternative will not change flow patterns; water will be collected at its existing overflow point and elevation, and then delivered to a portion of the stream to which it has overflowed in the past. The pipe on the ravine slope will be placed within a landslide scar created by past overflows. Work will not require the use of heavy machinery directly in the ravine. Material will be placed using a crane, skyline, or another similar method. Disturbance to the existing stream will be minimized. No work within the wetland is required.

2.4.1.3 Secondary Project Features

Secondary project features are summarized below:

Impervious surface. No net change in the amount of impervious surface will occur as a result of the proposed projects.

Secondary roadway improvements associated with this project. None.

Disposal sites for excavated material. Sediment is removed from the sediment pond annually. This is accomplished by diverting incoming flow through a bypass pipe, digging out the pond with a backhoe, and loading the removed sediment into dump trucks. This technique will be used during construction if sediment from the work areas fills up the pond before the annual cleanout date in September. Excavated materials from the project will be disposed of in approved sites only.

Staging area locations. See Figure 2 for staging area locations.

Dewatering operations. In order to facilitate construction of the in-stream features of the project, temporary water diversion structures would be installed to assist the dewatering of work areas when necessary. All work areas in the West and East Tributaries are anticipated to be dry during the in-water work window.

If turbidity standards are not being met (Appendix D), measures will be taken to control the source of sediment in the work area. Dewatering systems may be used as a method for turbidity reduction. Dewatering would be accomplished as follows:

Gravel bags will be placed across the stream above and below the section of the potential sediment source. Stream flow above the work area will collect above the upstream dam and will be pumped through a screened pipeline around the work area, and then delivered to the settling pond that will form above the lower gravel bag dam. Only surface water from the settling pond will be allowed to reenter the channel below the work area. Straw bales may be used to filter settling water if necessary. Turbidity will be monitored above and below the area, and no increases in turbidity will be allowed greater than five Nephelometric Turbidity Units (NTU) above baseline conditions (Washington State Surface Water Quality Standards). If increases above this threshold are observed during monitoring, in-stream work will be suspended until the site of erosion is managed and sufficiently controlled.

Construction Equipment. Construction of the West Tributary underground conveyance line will employ open-cut trenching along the pipeline pathways. Approximately 1,400 feet of pipeline will be installed using this method. It is anticipated that this work will be completed using standard construction equipment including dump trucks, rubber tired and/or tracked loaders, and excavators where access is currently possible.

Except where cranes may be used from the access road to deliver materials to the East Fork Overflow work areas, helicopters and skylines will be employed to transport equipment and materials to the worksites in the ravine to minimize the need for clearing and grubbing. Potential impacts of helicopter operation is discussed in the "Effects of the Action" section.

Grading. Grading and soil disturbance is also expected to occur in ravine project sections. Streambank stabilization sites will likely require some bank grading due to the level of stream-channel incision and bank instability. As the project is intended to reduce scour and

erosion in the tributary stream channels, erosion-risk sites will be stabilized through a combination of rockery installation/placement, LWD-flow deflectors, channel adjustment, or a combination of these techniques.

Clearing. The West Tributary bypass will be constructed as an open-cut trench. The route for the West Tributary bypass pipeline passes through residential lots and into the BPA right-of-way. Impacted residential lots are of low habitat value dominated by grasses. The BPA right-of-way is vegetated primarily with Scott's broom and Himalayan blackberry. Some of this vegetation will be cleared prior to trenching. Otherwise, little impact is anticipated during ravine stabilization due to the hand labor and low-impact delivery equipment that will be employed during the project. No trees over six inches diameter at breast height (dbh) will be removed during the project.

Wetland Impacts. No wetlands will be directly affected. The East Fork Wetland will be indirectly affected by the drainage features that will be installed along its lower perimeter, although the collection system will be designed to duplicate current drainage conditions.

2.5 Construction Activities

The Madsen Creek Erosion Stabilization Projects will be subdivided into the following six construction sites. The location of these projects and the construction details are shown in the construction plans included in Appendix B.

- 1) Northwest Tributary streambed stabilization.
- 2) East Fork Tributary streambed enhancement.
- 3) Mainstem streambed enhancement.
- 4) East Fork Wetland overflow construction.
- 5) West Tributary bypass pipeline.
- 6) BPA detention and water quality pond.

With one exception, heavy equipment will not operate in either a stream channel or riparian zone as part of the proposed work. A logging skyline, helicopter, crane, or hand crew will be used for virtually all material placement and movement. However, at the upper end of the northwest tributary, an excavator will operate from an existing road to place a small amount of material into the channel.

2.5.1 Northwest Tributary Streambed Stabilization Site

The Northwest Tributary ravine site extends from the head of the ravine, in the vicinity of 140th Way SE and SE 157th Place and extends to the confluence of the mainstem of Madsen Creek, spanning approximately 1,460 linear feet.

2.5.1.1 Preconstruction Activities; Northwest Tributary

- Trees to be used as tailhold anchors for the skyline will be flagged.
- Clearing limits will be flagged for the access road and skyline staging area
- A preconstruction meeting will be held. Attendance will be required of the following: contractor or county crew leads; design team biologist, engineer, geologist; water quality monitoring crew. Others invited will include representatives of the following organizations: Corps of Engineers, Muckleshoot Indian Tribe, State Fish and Wildlife, Department of Ecology, county grading inspector, and Homeowners Association representative. The agenda will include: Introduction; Review of the project and its goals; Review of the water quality monitoring process; and work alert and shut down levels.
- Notices will be sent to adjacent residences and schools regarding construction work and warn of hazards within the ravine during helicopter operations.
- Although no listed fish species are expected to occur in the 1,460 foot stream length, an effort will be made prior to construction to remove any fish and larger aquatic animals such as frogs and salamanders. Dip nets and herding techniques will be used. Although cutthroat have not been found to be present through previous surveys, any netted fish will be gently relocated to the unimpeded part of the stream.
- Scour-pool debris complex locations along the project site will be marked. Depth and position of boulders and logs will be determined according to plan. The proposed finished grade will be surveyed and staked for a boulder cascade.
- Overhanging limbs will be cleared and log placements marked in the field. Potentially hazardous snags in the flight path and stream enhancement area will be marked and felled.
- Water quality monitoring will continue throughout construction. Sampling will occur once every hour during construction, but more readings may be taken if turbid water is observed leaving the isolated work area. Monitoring stations will include a control site upstream of the project area, a site located at the confluence of the northwest tributary and the mainstem, the outlet of the Madsen Creek sediment pond, and the outlet of Madsen Creek at the Cedar River.
- The helicopter staging area will be established in one of two candidate areas. The first site is a vacant field (church vacant lot) at the bottom of the canyon located south of the Maple Valley Highway and immediately north of the Madsen Creek sediment pond. The second candidate area is located in an access road area leading from SE 164th Street just west of 162nd Avenue SE in Fairwood, north of the East Fork of Madsen Creek. The staging area will be used to store stream gravel, LWD, and boulders, and to load the construction helicopter, which will then transport instream materials to the work area. Helicopter refueling and maintenance will be performed at the staging area.

2.5.1.2 Construction Activities; Northwest Tributary

- Vegetation along the access road leading from 140th Way SE to the proposed skyline staging area as shown on the site plan will be cleared. Vegetation removal will include coniferous and deciduous trees. The access road will be graded and stabilized. Silt fences will be installed between the access road and the adjacent steep slope.
- An emergency temporary erosion control stockpile will be established at the skyline staging area, including: 40 straw bales, 5 rolls of plastic sheeting, 10 yards of clean pea gravel, 1 cubic foot per second (cfs) pump, and 100 feet of hose.
- A tailhold anchor for the skyline will be established using existing trees on the east side of the Madsen Creek ravine. These trees may need to be cut (topped) for safety. Vehicular access is not required to the tailhold area.
- A sandbag dam will be installed at the bottom of the Northwest Tributary. A pump will be placed to collect water from behind this dam, and a discharge line from the pump to the pasture area placed north of the sediment pond. This pump will be used to collect sediment-laden water from the northwest ravine if necessary, to prevent excessive turbidity in Madsen Creek.
- Approximately 12 to 15 days will be required to place materials by skyline. Logs and stumps will be moved by attaching them to a cable, suspended from a carriage, which rides on the skyline cable. The carriage is moved along the cable to position the wood, which is then lowered into position. Boulders and streambed gravel will be carried in a bucket or cargo net suspended from the carriage.
- If necessary, the skyline cable will be relocated to finish the positioning of LWD, boulders, and stream gravel using new tailhold tree.
- Approximately 3 to 5 days will be required to deliver materials by helicopter into the areas the skyline cannot reach. The main flight path will be between the staging area and the drainage site, a distance of approximately 3,600 feet. The secondary path will be between the project area and the refueling area, approximately 8,800 feet to the northwest.
- Helicopter-transported materials will be staged within the project area construction limits. Boulders, logs and unsorted stream gravels will be delivered to the site. Logs will be placed with a grapple or choker and placed at the direction of ground crew in the stream. One end of the log will be placed into the stream, then lowered, creating some instream disturbance when the log contacts the water. Gravel and rock boulders will be transported by helicopter using a bucket. Once on site, the helicopter will lower one end of the bucket to the water as the other end is lifted to dump the load.
- Approximately 1,460 linear feet of stream reach will be affected, or 5,900 square feet. The amount of fill below the OHWM within the stream will include 70 cubic yards of boulders, and 80 cubic yards of streambed gravel. There will be 53 logs placed in this reach.
- A hand labor crew will position rock and LWD in stream following helicopter or skyline placement.

- Water quality will continue to be monitored for downstream turbidity. If monitoring indicates that turbidity exceeds state standards, the rate of reintroduction will be reduced to maintain those standards. When monitoring indicates that turbidity matches background measurements, the sandbag dam will be completely removed.
- Native plants will be installed on the access road and disturbed areas in the winter of 2001-2002. Slopes and disturbed areas will be hydroseeded and mulched. Native plantings will be installed by hand to revegetate the ravine with conifers.

2.5.1.3 *Best Management Practices; Northwest Tributary*

All approved and necessary Best Management Practices (BMPs) will be used during construction of the project. These are described below.

- All work on the Northwest Tributary will be carried out between June 1 and September 30.
- If inclement weather results in excessive sediment discharge, construction activities will be modified or suspended to control sediment discharge.
- Silt fences will be in place before construction and clearing begins.
- A stabilized construction entrance will be installed.
- Erosion control measures will be left in place until site conditions stabilize and turbidity measurements match background levels.
- An effort will be made to remove any fish or other aquatic organisms found in the work area by herding and dip netting.
- Disturbed areas of the access road and skyline spar will be seeded and mulched upon completion of construction.
- Exposed earth surfaces will be covered to minimize discharges of sediment-laden water during rainstorms.
- Hydroseeding and mulching of disturbed areas will occur within 30 days of final grading, and prior to September 30th.
- The access road will be graded out and planted with native vegetation. The planting will take place during the subsequent dormant period (late fall/early winter). Planting will not occur near the stream or stream buffer.
- Sediment-laden water from the Northwest Tributary will be pumped to the field below the sediment pond for filtering and infiltration.

2.5.2 East Fork Tributary Streambed Enhancement Site

2.5.2.1 *Preconstruction Activities; East Fork Tributary*

The total length of the project area is 560 linear feet, which extends from the head of the ravine near the intersection of 157th Avenue SE and SE 167th Place to the confluence with the East Fork of Madsen Creek. A skyline system and helicopter will be used to place boulders and woody debris in this site.

- A preconstruction meeting will be held. Attendance will be required of the following: contractor or county crew leads; design team biologist, engineer, geologist; water quality monitoring crew. Others invited will include representatives of the following organizations: Corps of Engineers, Muckleshoot Indian Tribe, State Fish and Wildlife, Department of Ecology, county grading inspector, and Homeowners Association representative. The agenda will include: Introduction; Review of the project and its goals; Review of the water quality monitoring process; and work alert and shut down levels.
- Notices will be sent to adjacent residences and schools regarding construction work and hazards within the ravine during helicopter operations.
- The boundaries of the clearing limits will be flagged for the access road to the skyline system and the skyline main spar.
- Silt fences and rock access pad will be set up at the staging area. Emergency stockpiles will be established at staging area, including: 40 straw bales, five rolls of plastic sheeting, 10 yards of clean pea gravel, a one-cfs pump, and 100 feet of hose.
- Although no listed fish species are expected to occur in the roughly 600-foot stream work area during construction, an effort will be made to remove any fish and larger aquatic animals, such as frogs and salamanders. Dip nets and herding techniques will be used. Cutthroat have been found to be present through previous surveys. Any netted fish will be gently relocated to the unimpeded part of the stream.
- Scour-pool debris complex locations along the project site will be marked. Depth and position of boulders and logs will be determined according to the plans. Proposed finished grade will be surveyed and staked for a boulder cascade.
- Water quality monitoring will then be initiated and continued throughout construction. Sampling will occur once every hour during construction, but more readings may be taken if turbid water is observed leaving the isolated work area. Monitoring stations will include a control site upstream of the project area, a site located at the confluence of the northwest tributary and the mainstem, the outlet of the Madsen Creek sediment pond, and the outlet of Madsen Creek at the Cedar River.
- The helicopter staging area will be established in one of two candidate areas. The first site is a vacant field (church vacant lot) at the bottom of the canyon located south of the Maple Valley Highway and immediately north of the Madsen Creek sediment pond. The second candidate area is located in an access road area leading from SE

164th Street just west of 162nd Avenue SE in Fairwood, north of the East Fork of Madsen Creek. The staging area will be used to store stream gravel, LWD, and boulders, and to load the construction helicopter, which will then transport instream materials to the work area. Helicopter refueling and maintenance will be performed at the staging area.

2.5.2.2 Construction Activities; East Fork Tributary

- One or more tailhold trees will be used for anchoring the skyline cable on the south side of the canyon. These trees may need to be cut for safety.
- Overhanging limbs will be cleared and log placements marked in the field. Potentially hazardous snags in flight path and stream enhancement site will be marked and felled.
- Approximately 3 to 5 days will be required to place materials by skyline. Log and stumps will be moved by attaching them to the cable runner, hoisted off the ground, run out on the cable, and then lowered into position. Boulders and streambed gravel will be carried by the cable runner in a bucket or cargo net.
- The skyline cable will be relocated if necessary for finishing the positioning of LWD, boulders and stream gravel, or to find a new tailhold tree.
- Approximately 3 to 5 days will be required to deliver materials by helicopter to the areas the skyline cannot reach the East Tributary. The main flight path will be between the staging area and the drainage site, a distance of approximately 9,600 feet. The secondary path on the east fork path will be between the project area and the refueling area, approximately 1,600 linear feet to the northwest.
- Helicopter-transported materials will be staged within the project area construction limits. Boulders, logs and unsorted stream gravels will be delivered to the site. Logs will be placed with a grapple or choker and placed at the direction of ground crew in the stream. One end of the log will be placed into the stream, then lowered, creating some instream disturbance when the log contacts the water. Gravel and rock boulders will be transported by helicopter using a bucket. Once on site, the helicopter lowers one end of the bucket to the water as the other end is lifted to dump the load.
- Approximately 600 linear feet of streambed (2,900 square feet) will be stabilized. The amount of fill below the OHWM is 2.5 cubic yards of boulders and 11 cubic yards of streambed gravel. There will be a total of 26 logs placed into the stream in this section.
- A hand labor crew will position rock and LWD in stream following placement by helicopter or skyline.
- Monitoring for turbidity will continue downstream. If monitoring shows excessive sediment discharge, construction activities will be modified or suspended as required to control sediment release.

- Native plants will be installed on the disturbed areas in the winter of 2001-2002. Slopes and disturbed areas will be hydroseeded and mulched. Native plantings will be installed by hand to revegetate the ravine with conifers.

2.5.2.3 Best Management Practices; East Fork Tributary

All approved and necessary BMP's will be used during construction of the project. These are described below.

- All work on the East Fork Tributary will be carried out between June 1 and September 30.
- If inclement weather results in excessive sediment discharge, construction activities will be modified or suspended to control sediment.
- Silt fences will be in place before construction and clearing begins.
- Erosion control features will be left in place until site conditions stabilize and turbidity measurements match background levels.
- An effort will be made to remove any fish or other aquatic organisms found in the work area by herding and dip netting.
- Disturbed areas of the access road and skyline spar will be seeded and mulched upon completion of construction.
- Exposed earth surfaces will be covered to minimize discharges of sediment-laden water during rainstorms.
- Seeding and mulching of disturbed areas will occur within 30 days of final grading, and prior to September 30th.
- Native conifers will be planted along 560 feet of the East Fork stream buffer during the subsequent dormant period (late fall/early winter).

2.5.3 Mainstem Streambed Enhancement Site

The total length of the project area is 5,100 feet, which extends from Station 13+00 above the Madsen Creek sediment pond to 64+00, just downstream of the confluence of the East Fork and the mainstem of Madsen Creek. A helicopter will deliver and install the habitat stabilization features associated with site.

2.5.3.1 Preconstruction Activities; Mainstem

- A preconstruction meeting will be held. Attendance will be required of the following: contractor or county crew leads; design team biologist, engineer, geologist; water quality monitoring crew. Others invited will include representatives of the following organizations: Corps of Engineers, Muckleshoot Indian Tribe, State Fish and Wildlife, Department of Ecology, county grading inspector, and Homeowners

Association representative. The agenda will include: Introduction; Review of the project and its goals; Review of the water quality monitoring process; and work alert and shut down levels.

- The helicopter staging area will be established in one of two candidate areas. The first site is a vacant field (church vacant lot) at the bottom of the canyon located south of the Maple Valley Highway and immediately north of the Madsen Creek sediment pond. The second candidate area is located in an access road area leading from SE 164th just west of 162nd Ave SE in Fairwood, north of the East Fork of Madsen Creek. The staging area will be used to store stream gravel, LWD, and boulders, and to load the construction helicopter, which will then transport instream materials to the Northwest Tributary site. Helicopter refueling and maintenance will be performed in the pasture area north of the sediment pond.
- A silt fence and rock access pad will be set up at the staging area. An emergency stockpile will be established at the staging area, including: 40 straw bales, five rolls of plastic sheeting, 10 yards of clean pea gravel, a one-cfs pump, and 100 feet of hose.
- Although no listed fish species are expected to occur in the 5,100 foot-length of all stream work areas, an effort will be made to remove any fish and larger aquatic animals, such as frogs and salamanders. Dip nets and herding techniques will be used. Although cutthroat have not been found to be present through previous surveys, any netted fish will be gently relocated to the unimpeded part of the stream.
- Boulder/debris locations will be surveyed and marked along the project site.
- Overhanging limbs will be cleared and log placements marked in the field. Potentially hazardous snags in the flight path and stream enhancement site will be marked and felled.
- Water-quality monitoring will continue throughout construction. Monitoring will occur once every hour during construction, but more readings may be taken if turbid water is observed leaving the isolated work area. Monitoring stations will include a control site upstream of the project area, a site located at the confluence of the northwest tributary and the mainstem, the outlet of the Madsen Creek sediment pond, and the outlet of Madsen Creek at the Cedar River.

2.5.3.2 Construction Activities; Mainstem

- Approximately 3 to 5 days will be required to deliver materials by helicopter into the roadless section of the mainstem. The main flight path will be between the staging area and the drainage site, varying a distance of approximately 1,600 to 8,000 feet. The secondary alternative path will be between the project area and the refueling area, varying approximately 3,800 linear feet near the east fork to 8,000 near the sediment pond.
- Crews will monitor access to the site; they will be equipped with radio or telephone to warn of non-work crew persons entering the ravine.

- Helicopter-transported materials will be staged within the project area construction limits. Boulders, logs and unsorted stream gravels will be delivered to the site. Logs will be placed with a grapple or choker and placed at the direction of ground crew in the stream. One end of the log will be placed into the stream, then lowered, creating some instream disturbance when the log contacts the water. Gravel and rock boulders will be transported by helicopter using a bucket. Once on site, the helicopter lowers one end of the bucket to the water as the other end is lifted to dump the load.
- Approximately 84 logs, 17 cubic yards of boulders, and 3 cubic yards of streambed gravel will be placed below OHW along this 5,100 linear feet of stream. The installed wood and boulders will cover an estimated 11,600 square feet of streambed area.
- Hand labor crews will position rock and LWD in the stream following helicopter placement.
- Continue to monitor water quality for downstream turbidity. If monitoring indicates that turbidity exceeds state standards, the rate of reintroduction will be reduced to maintain those standards. When monitoring indicates that turbidity matches background measurements, the sandbag dam will be completely removed.
- Native plants will be installed on the disturbed areas in the winter of 2001-2002. Slopes and disturbed areas will be hydroseeded and mulched. Native plantings will be installed by hand to revegetate 4,000 feet of the ravine with conifers.

2.5.3.3 *Best Management Practices; Mainstem*

All approved and necessary BMP's will be used during construction of the project. These are described below.

- All work in the mainstem of Madsen Creek will be carried out between June 1 and September 30.
- If inclement weather results in excessive sediment discharge, construction activities will be modified or suspended to control sediment discharge.
- Silt fences will be in place before construction and clearing begins.
- Erosion control features will be left in place until site conditions stabilize and turbidity measurements match background levels.
- An effort will be made to remove any fish or other aquatic organisms found in the work area by herding and dip netting.
- Disturbed areas of the access road and skyline spar will be seeded and mulched upon completion of construction.
- Exposed earth surfaces will be covered to minimize discharges of sediment-laden water during rainstorms.
- Hydroseeding and mulching of disturbed areas will occur within 30 days of final grading, and prior to September 30th.